

THE EFFECT OF UNCONFINED MINE TAILINGS ON THE GEOCHEMISTRY OF SOILS, SEDIMENTS AND SURFACE WATERS OF THE LOUSAL AREA (IBERIAN PYRITE BELT, SOUTHERN PORTUGAL)

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ABSTRACT

The former Lousal mine, on the SW limb of the Lousal anticline, closed in 1988. Today Lousal is a small village, with much evidence of environmental and landscape disturbance. This is largely the legacy of mining and mine tailings dumped around the site, which, in turn, caused soil contamination and acid mine drainage. Particular attention is being given by the Portuguese Government to this sort of problem, bearing in mind the State's responsibilities for the abandoned mine sites that occur in many parts of the Country.

Despite the semiarid climatic conditions of the area, a visual inspection of the mine site indicates that the tailings are affected by considerable water erosion, particularly during large rainfall events.

Significant amounts of Cu, Pb, Zn, As, Cd and Hg, occur within the soil collected near the tailing deposits (292–7013 mg kg⁻¹ Cu, 871–12 930 mg kg⁻¹ Pb, 126–7481 mg kg⁻¹ Zn, 597–6377 mg kg⁻¹ As, 0.2–16.4 mg kg⁻¹ Cd and 1–130 mg kg⁻¹ Hg) and in stream sediments downstream of the tailings site (1–1986 mg kg⁻¹ Cu, 41–5981 mg kg⁻¹ Pb, 17–1756 mg kg⁻¹ Zn, 6–1988 mg kg⁻¹ As and 0.2–5.7 mg kg⁻¹ Cd). All the soil samples collected in the tailings deposits exceed the permissible levels.

Near the mine site, significant acid mine drainage is associated with the pyritic material and such waters show values of pH ranging from 1.9 to 2.9 and concentrations of 9249 to 20 700 mg L⁻¹ SO₄²⁻, 959 to 4830 mg L⁻¹ Fe and 136 to 624 mg L⁻¹ Al. Meanwhile, the acid effluents and mixed stream waters also carry high contents of SO₄²⁻, Fe, Al, Cu, Pb, Zn, Cd, and As, generally exceeding the Fresh Water Aquatic Life Acute Criteria. Copyright © 2005 John Wiley & Sons, Ltd.

KEY WORDS: mine pollution; tailings erosion; enrichment index; AMD; selective chemical extraction; southern Portugal

INTRODUCTION

Mine waste material containing sulphide waste is an important threat to the environment, being able to affect extensively mined areas or localized concentrations in 'hot spots'. Small portions of metals occurring in the mined ores, in general, are not totally recovered by mill and processing operations, and thus are left in tailings deposits. Such mining waste, containing significant concentrations of metals, is a source of present-day chemical pollution that possibly will persist for a long time (Marcus, 1997). Due to the inherent chemical and physical (slope) instability and other potential environmental problems, such contamination is a matter of long-term public concern (OSHA, 1990). The mode of occurrence of this waste (in general, fragmented and finely-ground materials)

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